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THESIS

INFORMATIONAL ANALYSIS OF THREE-WORD VERBAL DISCRIMINATION LEARNING

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Informational Analysis of Three-word Verbal Discrimination Learning

by

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ABSTRACT

Forty Naval Postgraduate School students participated in a verbal discrimination (VD) experiment using three-word items of different frequency ratios. Half of the three-word items were composed of similar words and half, dissimilar words. Based on information theory the words were grouped into two lists, both of equal length and approximately equal information. Performance by the subjects showed statistical significance for the trial and item similarity main effects and for the test by item similarity interaction. The effect of using different frequency ratios within the separate word lists showed a facilitation of learning only for items with similar words. Apparently, the differential ratios were not sufficiently apparent in the dissimilar items to permit the use of preexperimental frequency differences as a cue to learning.

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I. INTRODUCTION

In recent years many experiments have been conducted to test various postulates dealing with verbal discrimination (VD) learning. Most of these VD experiments (Ekstrand, Wallace and Underwood, 1966; Underwood and Freund, 1969; and Kausler and Farzanegan, 1969) have been restricted to testing hypotheses using two-word VD lists. A logical extension in this area was to test whether conclusions drawn from these two-word items were valid for VD lists containing three or more words per item. More specifically this study, through the use of three-word VD lists, examined the possible existence of preexperimental frequency as a variable in affecting the cue for discrimination between correct (C) and incorrect (I) words of a VD item (Ekstrand et al., 1966).

VD learning can also be analyzed using information theory where the initial probability of choice for each word in a VD list is estimated through background exposure, and positive reinforcement for each correct response is provided. The transfer of information contained within the list may then be measured by the subject's progress among repeated trials as he replies with correct responses.

Two lists, each 12 items long with each item containing three words, were constructed using two different frequency ratios; 3:1:1 (HLL) and 1:2:2 (LHH). The information content for each list was defined as:

$$\text{Information Content} = \sum_{k=1}^{12} \left[\sum_{i=1}^{3} (p_i \log_2 p_i) \right] k$$

where k is the kth item within the list and p_i is the probability of occurence of

the ith word within the kth item. P_i may also be expressed as the a priori probability of choice for each word within the VD item. The HLL list therefore contained 16.6 bits of information with each item within the list containing 1.38 bits of information. List LHH contained 18.2 bits of information with each item within the list containing 1.52 bits of information.

Using these notions, this study examined the learning of three-word VD items using the two lists with different frequency ratios. The correct response for the lists were either the singular frequency word (HLL-High correct or LHH-Low correct) or one of the similar frequency words (HLL-Low correct or LHH-High correct). Mixed correct responses (HLL-either correct or LHH-either correct) were not examined.

Preexperimental predictions within the areas of interest were that the two "singular" lists, HLL-H and LHH-L, would be learned more rapidly by subjects than the two similar frequency lists, HLL-L and LHH-H. These predictions were based on the following assuptions from VD frequency theory:

1) Subjects are capable of differentiating the high and low frequency words comprising VD lists.
2) Subjects could use rule 1 (Ekstrand et al., 1966), "always select the more frequent of the words," in the HLL-H condition and rule 2, "always select the least frequent of the words," in the LHH-L condition. In the HLL-L and LHH-H conditions, however, the subjects could use either rule as an initial step toward discriminating the correct response, but an additional discrimination was required between the words with two similar frequencies for which neither rule applies a priori.

3) In addition, if rule 1 is easier to apply than rule 2, learning should be easier for the HLL-L and LHH-H groups combined vs. the LHH-L and HLL-L groups combined.

Similar predictions would be made on the basis of information theory if it is assumed that the initial probability of a response choice is random. Then, the choices for each VD item are placed in a 2 x 3 matrix with the row headings classified as correct response (C) and incorrect response (I) and the column headings classified in accordance with the frequency ratio of the words within the VD item. X_{ij} (i=1,2; j=1,2,3) are the values within the matrix and represent the number of responses corresponding to the ith row and jth column. For the first trial of the HLL-H condition in which the responses are assumed to be completely random the matrix is as follows:

	H	L	L
C	1/3	0	0
I	0	1/3	1/3

The informational value of each test item can then be computed by using:

Informational Value (IV) = p(Y) + p(Z) - p(YZ)

where Y is the marginal value of each row, Z is the marginal value of each column and YZ the product of the X_{ij}'s;

	H	L	L	Y
C	1/3	0	0	1/3
I	0	1/3	1/3	2/3
Z	1/3	1/3	1/3	YZ = 3(1/3)

$IV = (1/3 \log_2 1/3 + 2/3 \log_2 2/3) + 3(1/3 \log_2 1/3) - 3(1/3 \log_2 1/3)$

$IV = 0.9149$ for item HLL-H.

The informational value for all four types of test items were found in the same manner and are tabulated in Figure 1.

FIGURE 1.

HYPOTHETICAL INFORMATIONAL VALUE OF TEST MODES AFTER FIRST TRIAL

Item Type	IV
HLL-H	0.9149
HLL-L	0.2321
LHH-L	0.9149
LHH-H	0.2321

The informational value for each item indicates that after the first trial, the results of which are assumed to be completely random, the subjects receiving items HLL-H and LHH-L should have received 0.9149 bits of information about their respective lists, i.e. reduced their uncertainty about their lists by 0.9149 bits. The subjects receiving items HLL-L and LHH-H should have reduced their uncertainty about their respective lists by 0.2321 bits. Therefore the subjects participating in the tests having the singular frequency word correct should receive approximately four times as much information about their lists than the subjects participating in the other two lists. Accordingly, VD learning should favor those subjects using the singular-correct lists.

II. METHOD

A. WORD LISTS

Two word lists were constructed for use in the experiment, each consisting of 12 items, with each item consisting of three words. Each list therefore consisted of 36 different words. The first list was constructed so that one of the words within each item had a higher frequency count when compared with the remaining two words. This high-low-low (HLL) group of words had a frequency ratio of 3:1:1. The second list was constructed so that one of the words within each item had a low frequency count when compared with the remaining two words. This low-high-high (LHH) group of words had a frequency ratio of 1:2:2.

Word selection for inclusion within each list was accomplished in two phases; first by category norms as found in Battig and Montague (1969), and then by general count or frequency as found in Thorndike and Lorge (1944). First, categories having at least a .9 correlation over test subjects for verbal items as compiled by Battig and Montague (1969) were identified as the source for words. In six of the items within each list, the three words comprising the item were selected from words from the same verbal category. The remaining six items were constructed so that each of the three words within an item were selected from three different verbal categories. This arrangement of six similar and six dissimilar items served to examine verbal discrimination as a function of the homogeneity of the choices. After the categories were selected, words were chosen using the Thorndike and Lorge (1944) general count in the proper frequency ratios. Words having the

highest general count possible within the ratio criterion were used to insure all the subjects would be relatively familiar with the words comprising the lists. The categorical selection, high background exposure, and similarity were necessary criteria in list composition to reduce rate of learning bias (Sidowski, 1966).

From the two lists of words four tests were then constructed. Two of the tests used the singular frequency word as the correct response. That is, in the HLL list the high frequency word was designated as correct (HLL-H), and in the LHH list the low frequency word was designated as correct (LHH-L). For the remaining two lists the correct responses were selected at random among the two remaining words having the same general count. The four tests therefore were:

Test I	HLL-H
Test II	HLL-L
Test III	LHH-L
Test IV	LHH-H

The word lists and correct responses for each test are shown in Figure 2.

B. CONDITIONS AND PROCEDURE

Each test presented to a subject consisted of the twelve items or groups of words repeated for eight consecutive trials. A control feature of making each list twelve items long was used rather than adjusting the length of the two lists to contain the same information value, i.e. bits of information. List length and number of trials were chosen by a short pilot study of five subjects. The final list length and number of trials were chosen so that most of the subjects would show an adequate amount of learning and some, but not all, subjects would be capable of learning the correct responses for all of the items on the list

Each test was made up consisting of four random arrangements of the items within the list and with a random arrangement of the words within each item. Each subject received all four of the random arrangements twice during the test period. For each subject, the starting point for each test was changed to reduce the likelihood that any single item could influence the overall results to any great extent.

Prior to each test the subjects were read a set of instructions (Appendix A) on the task and procedures. The test was then presented to each subject individually using a modified anticipation method on a Lafayette high-speed memory drum. The subject would observe the word group for a presentation interval of two seconds and then would respond with what he believed to be the correct response during a two-second response interval. Positive reinforcement was given to the subject each time a correct response was chosen; otherwise, there was no response from the test administrator. The eight trials were given consecutively to the subjects.

C. SUBJECTS

The 40 subjects used in the experiment were graduate level, military officer students in the operations research curriculum at the Naval Postgraduate School. The subjects were volunteers and were randomly assigned to one of the four test groups.

FIGURE 2.

WORD LISTS

LIST HLL

CORRECT RESPONSE FOR TEST I		CORRECT RESPONSE FOR TEST II
HOUR	OWL	SPOON
CHINA	DONKEY	HIP
PEA	CLAUSE	NIECE
VAN	ETERNITY	LIVER
TYPHOID	JANITOR	LADLE
PRUNE	CANCER	THRUSH
SOCK	SANDAL	CLOG*
GOLD	BRASS	TIN*
GREECE	CHILE	CUBA*
MODERN	SLOW	SWING*
PLUM	RAISIN	APRICOT*
CANVAS	MUSLIN	TWEED*

LIST LHH

CORRECT RESPONSE FOR TEST III		CORRECT RESPONSE FOR TEST IV
TEA	FRANCE	UNCLE
OXYGEN	TENT	PINK
ONION	MINISTER	SENATE
TRACK	CHURCH	BLUE
CARL	NAIL	APPLE
MEDICINE	FISH	MOTHER
FRAME	WALL	DOOR*
NOUN	VOWEL	VERB*
THUNDER	RAIN	WIND*
WREN	SWAN	DOVE*
BAT	MARBLE	PUZZLE*
JANE	JOY	MARY*

* Denotes similar word groups.

III. RESULTS

Table I presents the percent of correct responses per trial for each of the four test modes used. Figure 3 is a graphical presentation of this data and Figure 4 is a composite plot of the average percent of correct responses of all tests over trials.

TABLE I

PERCENT OF CORRECT RESPONSES PER TRIAL PER TEST MODE

TRIAL	TEST I	TEST II	TEST III	TEST IV
1	38.33	26.66	34.66	32.50
2	45.00	35.83	45.00	49.16
3	60.00	50.00	55.83	48.33
4	59.17	60.00	59.17	59.17
5	62.50	64.16	69.16	70.00
6	71.66	70.83	78.33	75.00
7	76.66	85.00	85.83	79.16
8	83.33	81.66	90.00	84.16

Tables II and III present the percent of correct responses per trial as a function of item similarity. Figures 5, 6, 7 and 8 are graphic presentations for each test mode, respectively, using item similarity as a parameter. Figure 9 is a composite graph of all tests for item similarity over trials.

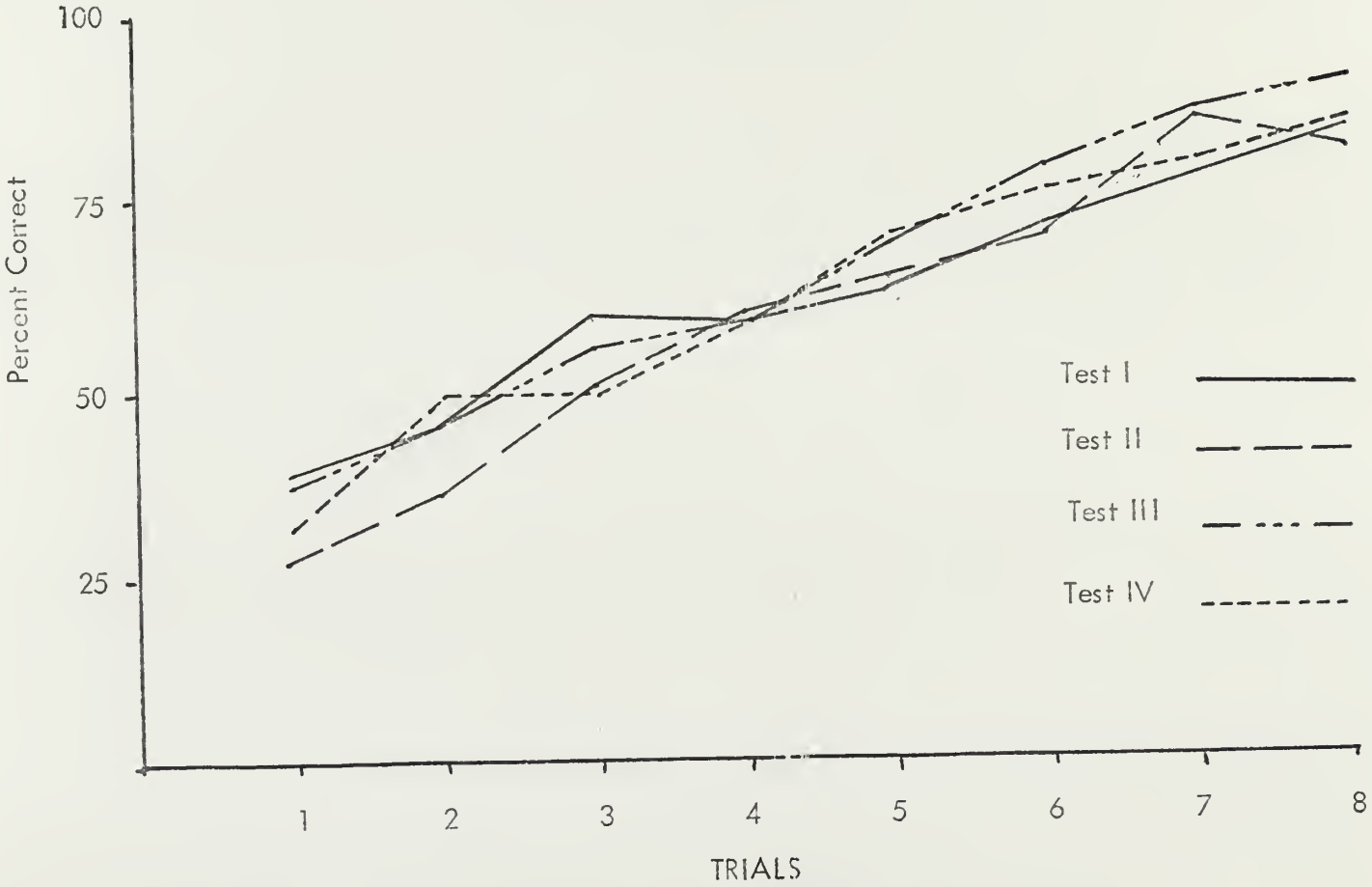

Figure 3. PERCENT CORRECT RESPONSES FOR EACH TEST

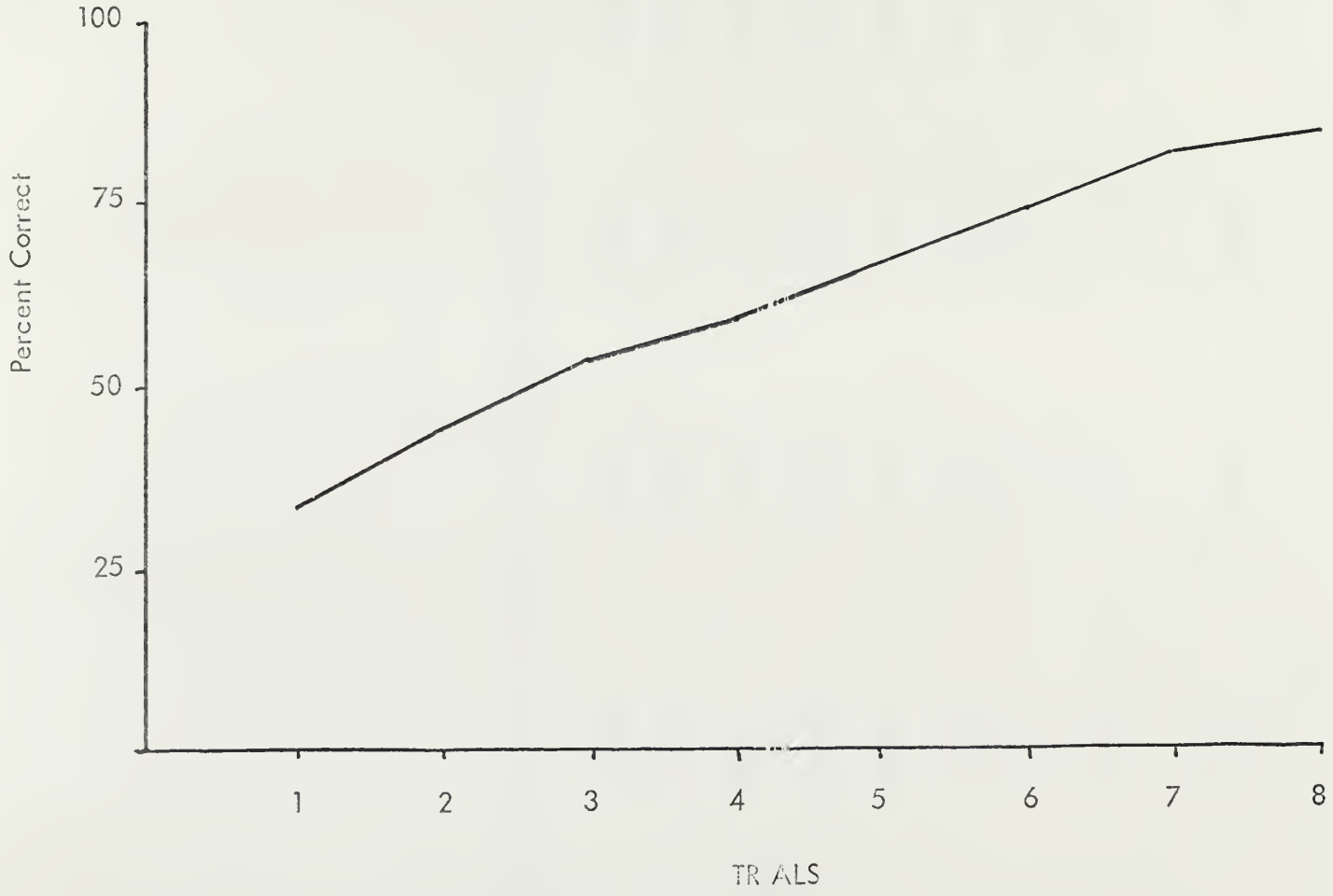

Figure 4. AVERAGE PERCENT CORRECT RESPONSES FOR ALL TRIALS

TABLE II

PERCENT OF CORRECT RESPONSES FOR SIMILAR ITEMS

TRIAL	TEST I	TEST II	TEST III	TEST IV
1	36.66	26.66	36.66	35.00
2	51.66	40.00	53.33	53.33
3	66.66	51.66	61.66	50.00
4	66.66	58.33	68.33	53.33
5	68.33	60.00	73.33	66.66
6	76.66	71.66	81.66	71.66
7	78.33	85.00	90.00	73.33
8	85.00	83.33	93.33	80.00

TABLE III

PERCENT OF CORRECT RESPONSES FOR DISSIMILAR ITEMS

TRIAL	TEST I	TEST II	TEST III	TEST IV
1	40.00	26.66	36.66	30.00
2	38.33	31.66	36.66	45.00
3	53.33	48.33	50.00	46.66
4	51.66	61.66	50.00	65.00
5	56.66	68.33	65.00	73.33
6	66.66	70.00	75.00	78.33
7	75.00	85.00	81.66	85.00
8	81.66	80.00	86.66	88.33

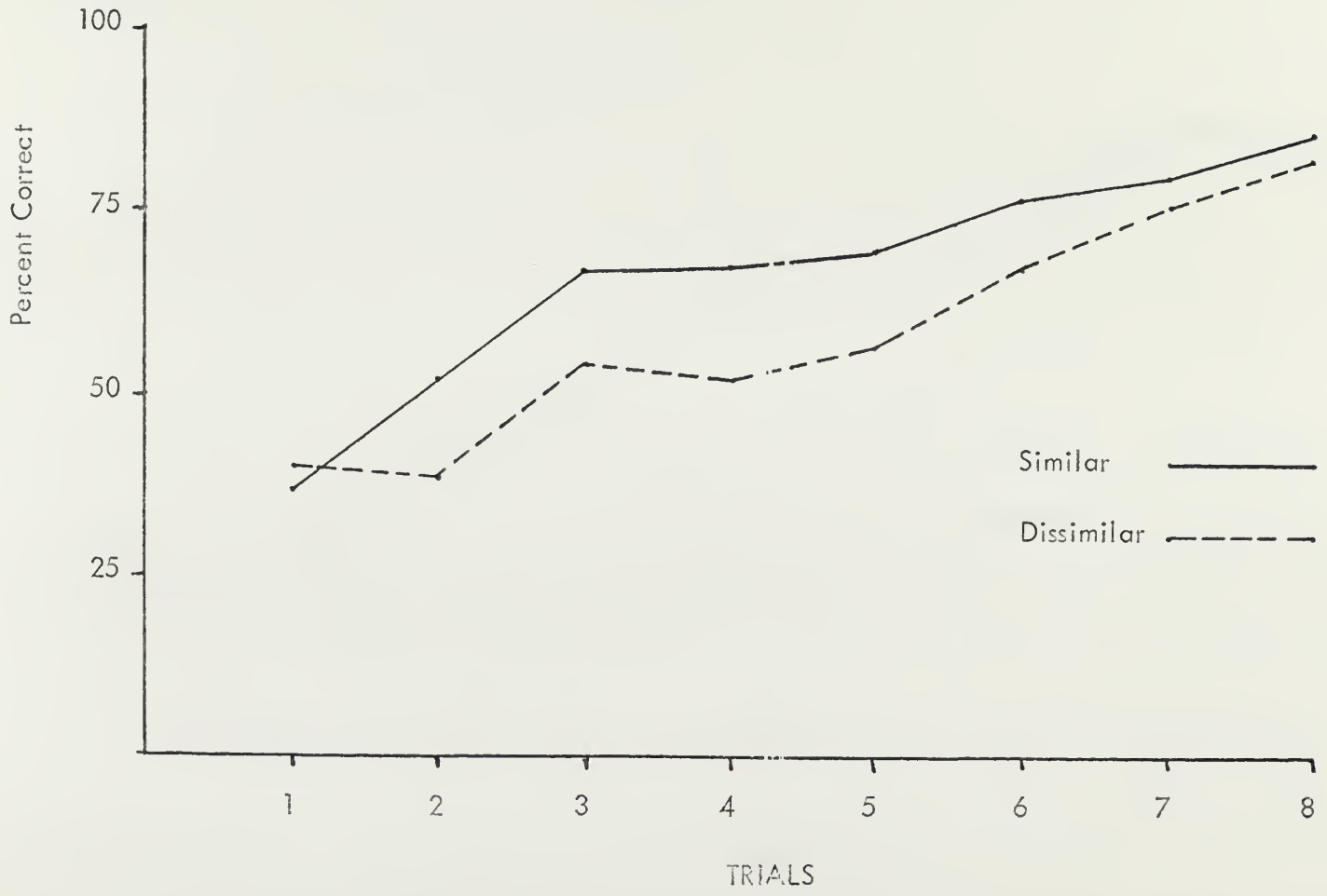

Figure 5. PERCENT CORRECT RESPONSES FOR SIMILAR AND DISSIMILAR ITEMS, TEST I

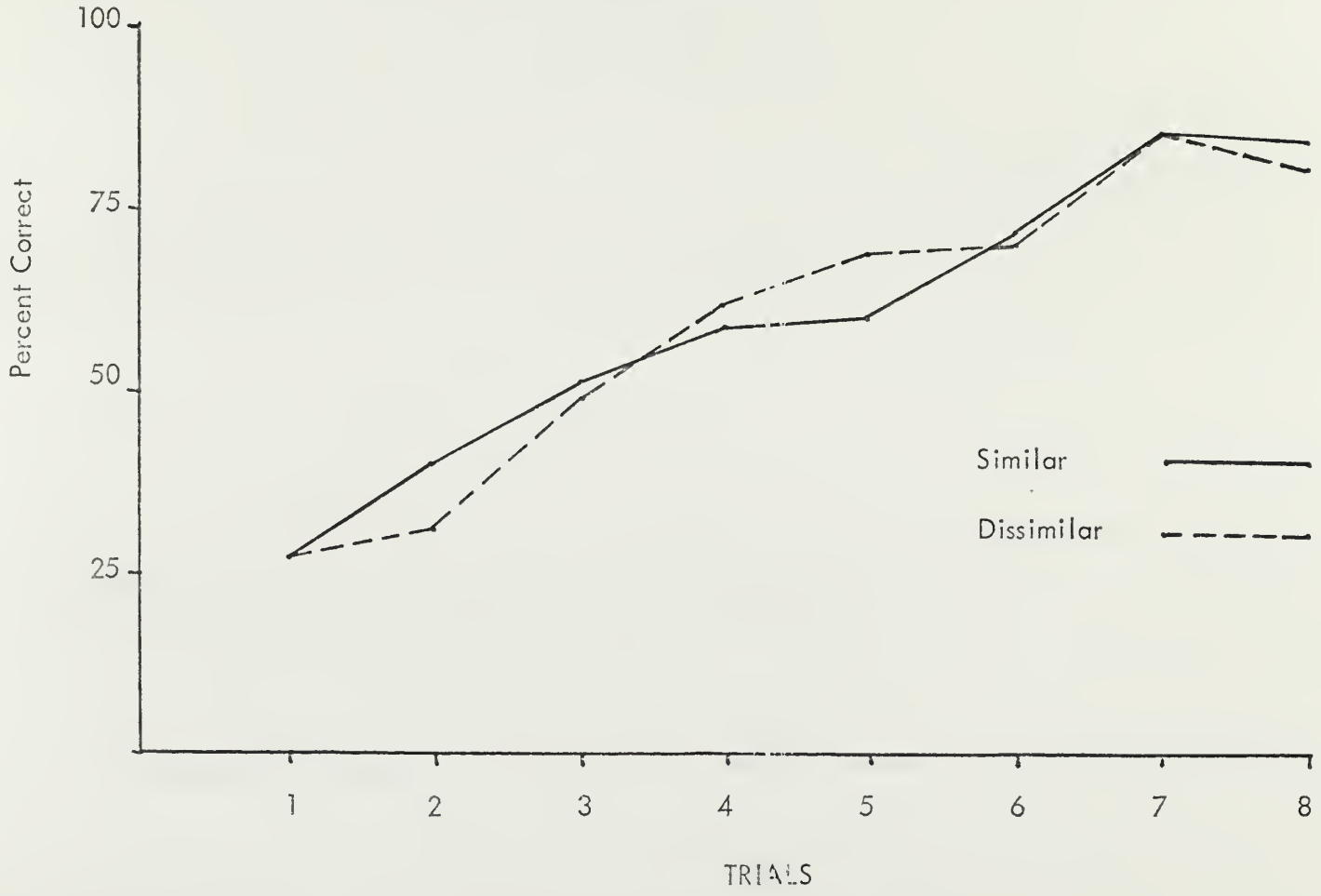

Figure 6. PERCENT CORRECT RESPONSES FOR SIMILAR AND DISSIMILAR ITEMS, TEST II

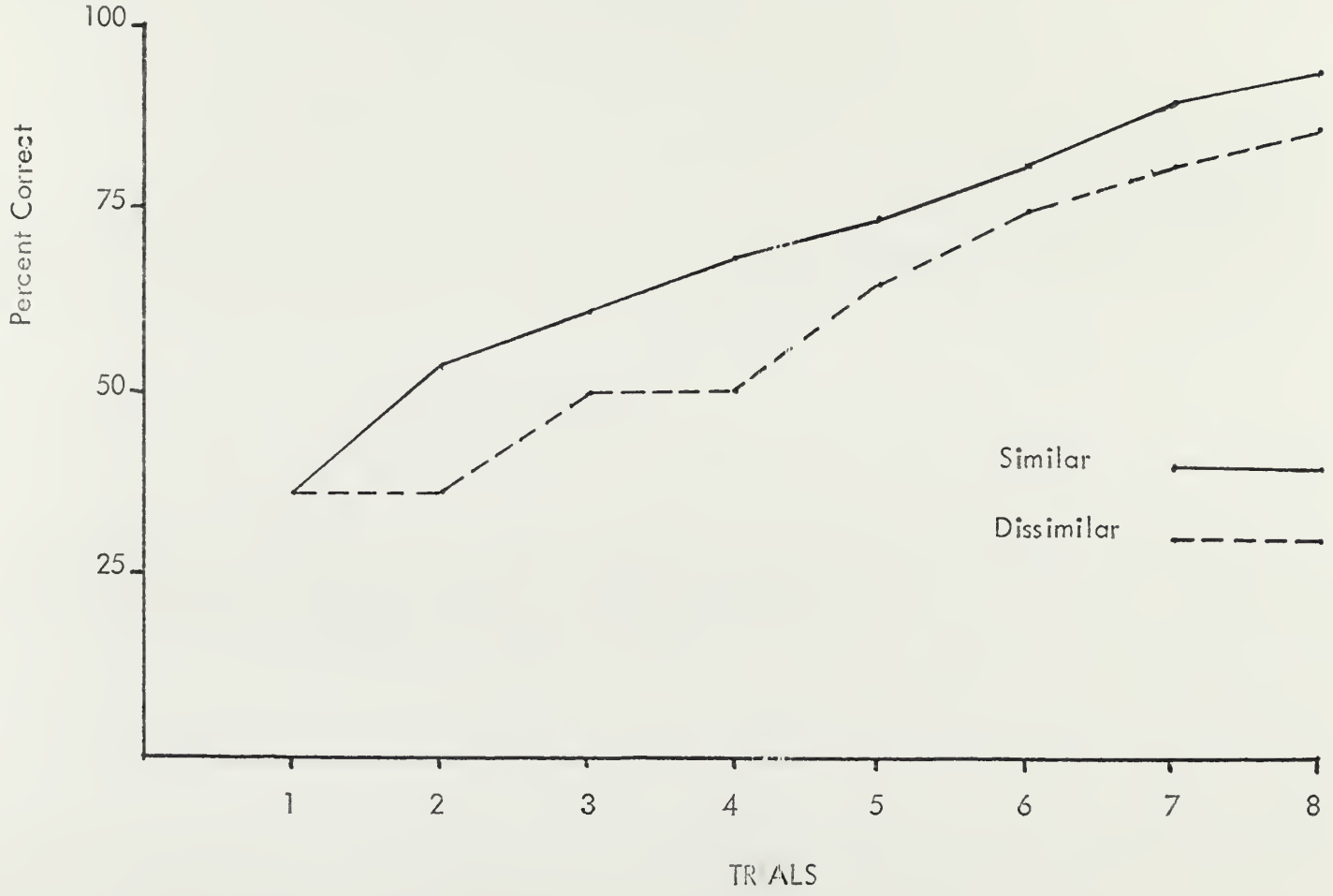

Figure 7. PERCENT CORRECT RESPONSES FOR SIMILAR AND DISSIMILAR ITEMS, TEST III

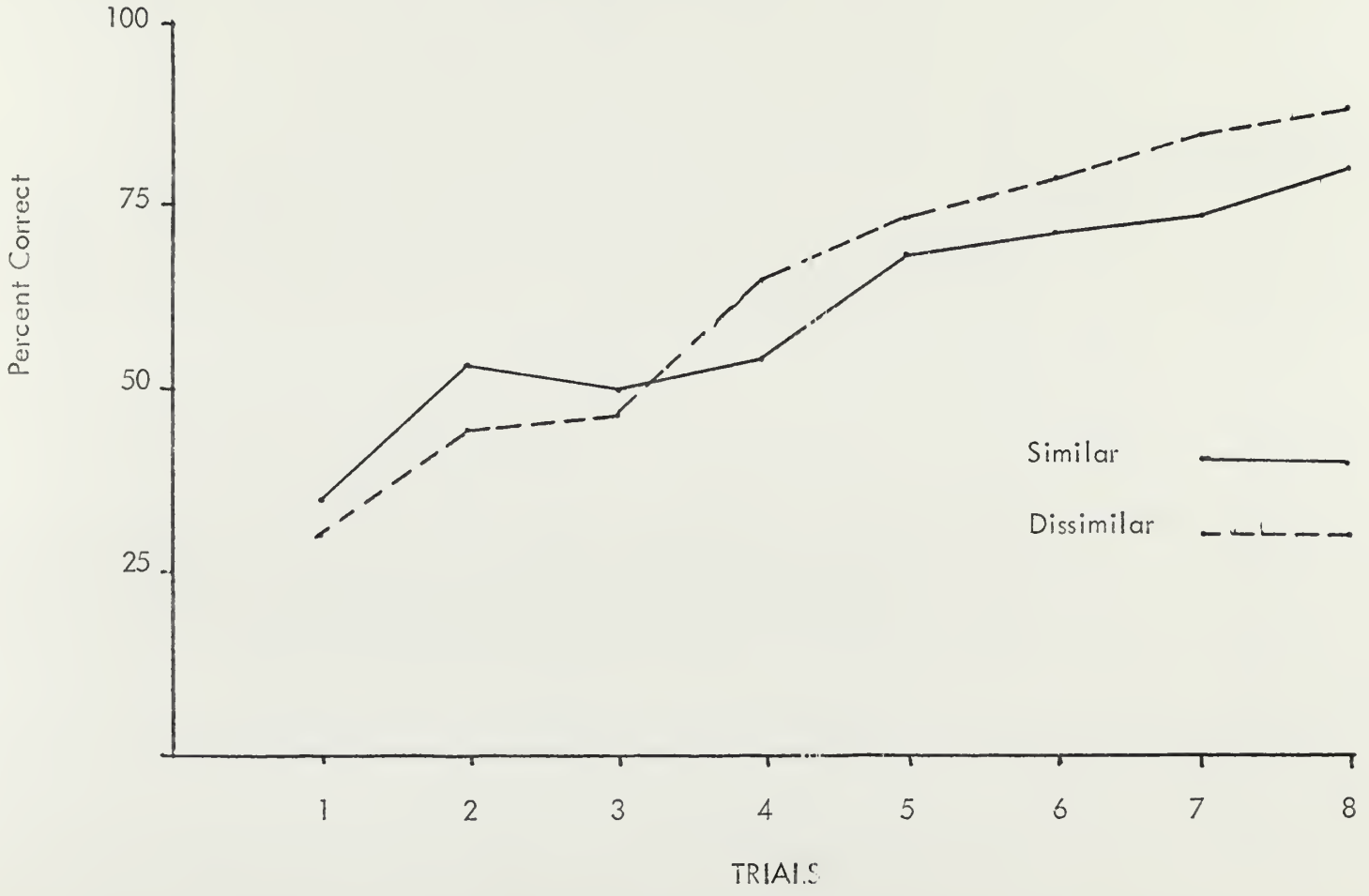

Figure 8. PERCENT CORRECT RESPONSES FOR SIMILAR AND DISSIMILAR ITEMS, TEST IV

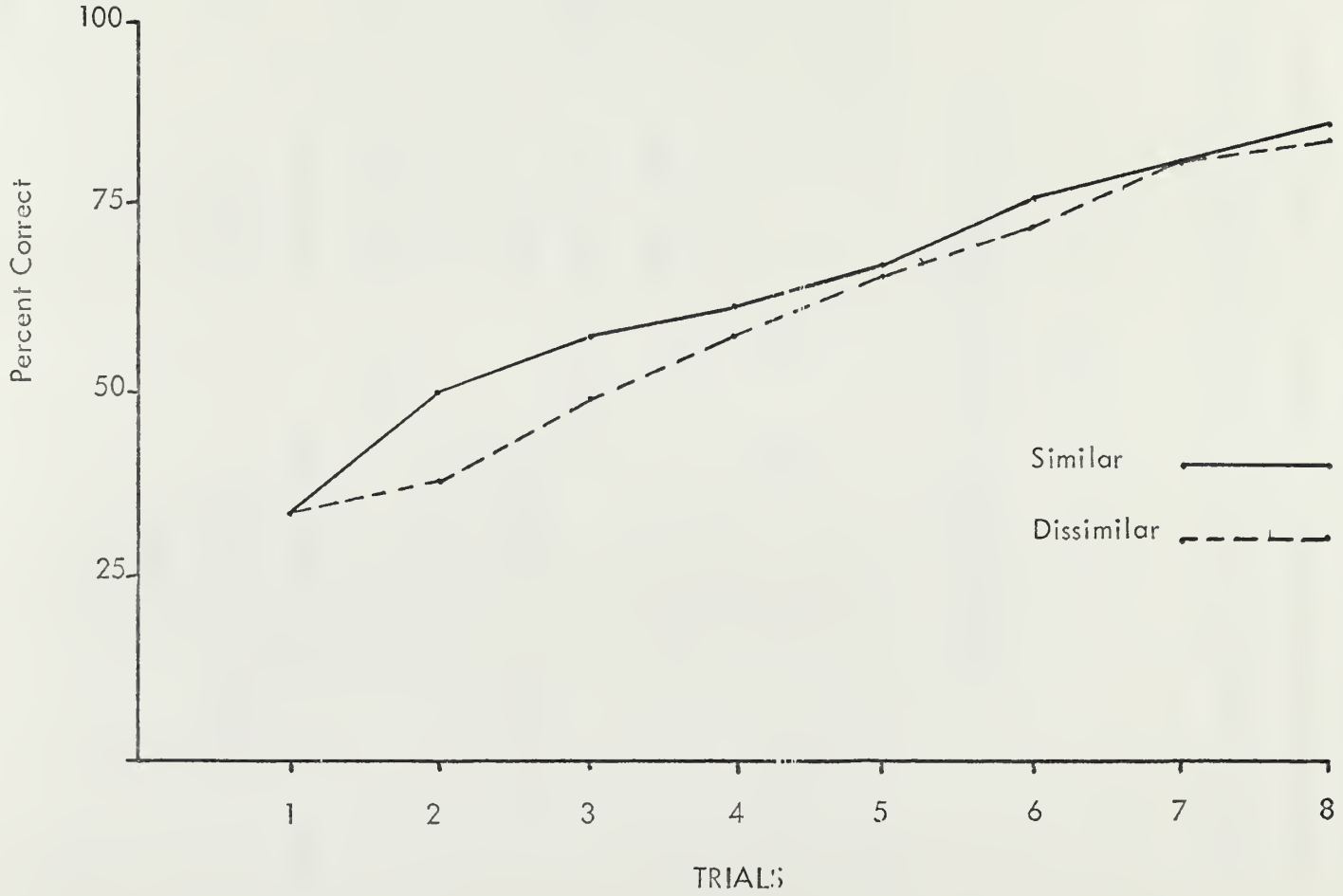

Figure 9. AVERAGE PERCENT CORRECT RESPONSES FOR SIMILAR AND DISSIMILAR ITEMS, ALL TESTS

The collected data was then analyzed using an analysis of variance for all subjects over tests and trials. The results are shown in Table IV. In this analysis the tests were a between subjects treatment and the trials were a within subjects treatment. For the computations in the analysis of variance the eight trials were blocked into four blocks of two trials per block. A graph showing the percent of correct responses for the blocked trials for each of the four test modes is shown in Figure 10.

TABLE IV

ANALYSIS OF VARIANCE OVER SUBJECTS FOR TESTS AND TRIALS

SOURCE OF VARIATION	SS	df	MS	F	p
Total	4580.7308	159	-	-	-
Between Subjects	1312.7740	(39)	-	-	-
Tests	37.8249	3	12.6083	0.3560	***
Error(b)	1247.9491	36	35.4153	-	-
Within Subjects	3267.9565	(120)	-	-	-
Trials	2520.8176	3	840.2725	131.6647	< .001
Test x Trials	56.3271	9	6.2586	0.9785	***
Error(w)	690.8118	108	6.3964	-	-

***Not significant

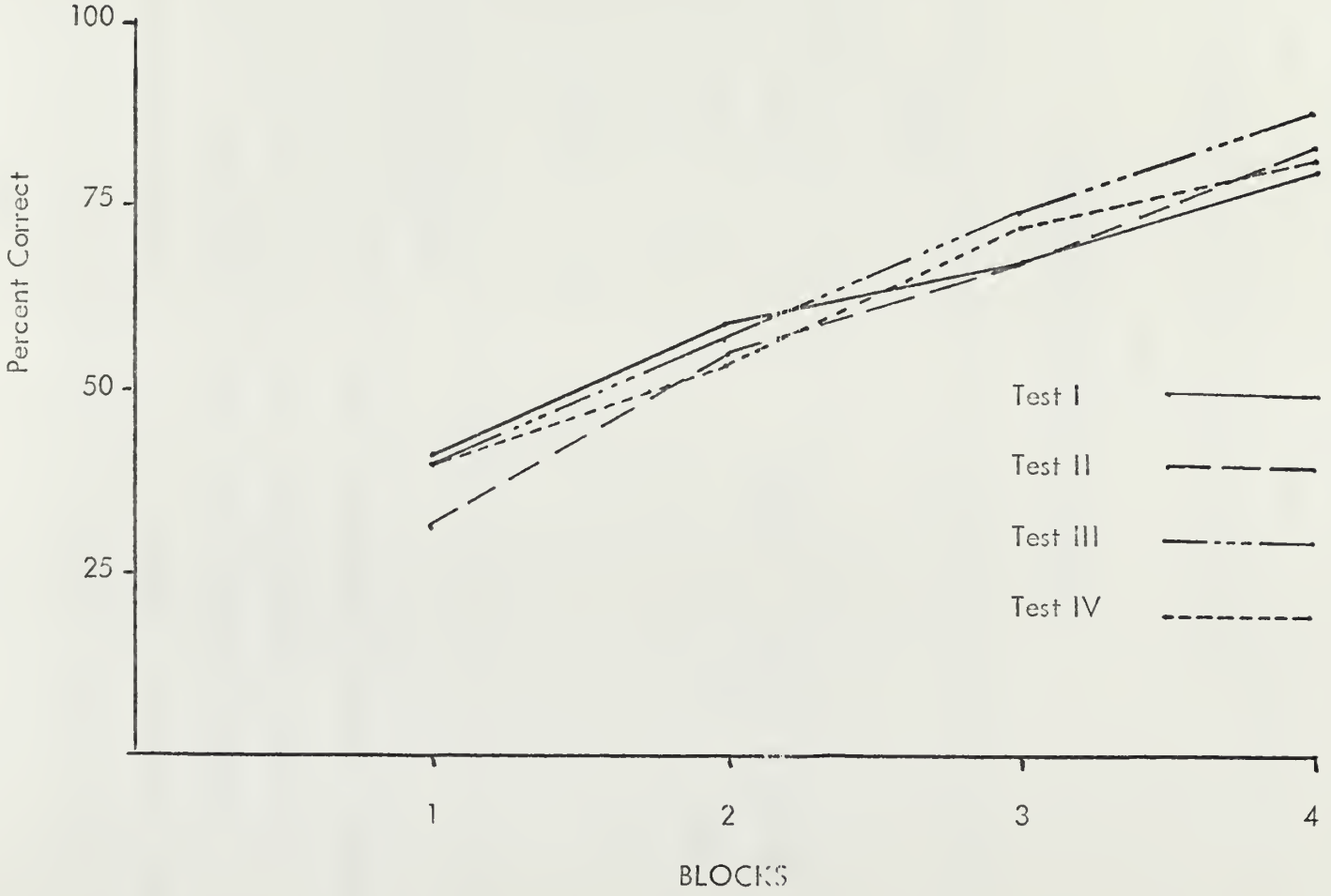

Figure 10. PERCENT CORRECT RESPONSES FOR EACH TEST OVER BLOCKED TRIALS

The results of Table IV indicate a statistical significance for the trial main effect whereas the test main effect and the test by trial interaction are not statistically significant. A Scheffé comparison test among trial means was used to evaluate the significance of the trial main effect. The results of the Scheffé test shown in Table V indicate that significant differences exist between the trial means for all of the groups except between groups three and four.

TABLE V

SCHEFFÉ TEST FOR TRIAL MEANS

TRIALS	MEANS	1	2	3	4
1	9.275	-	4.975*	7.575*	10.700*
2	13.55	-	-	3.500*	6.425*
3	16.85	-	-	-	3.125
4	19.975	-	-	-	-

* Denotes a significant difference.

An analysis of variance was then utilized to analyze the effects for all subjects over tests and item similarity. The tests were a between subjects treatment and the item similarity, a within subjects treatment. The results of this analysis, Table VI shows that statistical significance exists for the item similarity main effect and for the test by item similarity interaction. As in Table IV, there is no significance over the four test modes.

TABLE VI

ANALYSIS OF VARIANCE OVER SUBJECTS FOR TESTS AND ITEM SIMILARITY

SOURCE OF VARIATION	SS	df	MS	F	p
Total	2955.55	79	-	-	-
Between Subjects	2625.55	(39)	-	-	-
Tests	75.65	3	25.2167	0.356	***
Error(b)	2549.90	36	70.8306	-	-
Within Subjects	330.00	(40)	-	-	-
Item Similarity	62.30	1	62.30	17.3455	< .001
Test x Item Similarity	129.30	36	3.5917	-	< .001

*** Not significant

These two analyses indicate no statistical significance for the test main effect. The two analyses indicate that statistical significance exists for the trial and item similarity main effects and for the test by item similarity interaction. The significance of the trial main effect is readily understandable when the results of the repeated trials are approached as a learning curve for the subjects. The subjects continued to improve over each trial, however, the rate of improvement decreased as the number of trials increased. This explains why the Scheffé test indicated a significant difference between all of the blocked trials except between blocks

three and four. The item similarity main effect significance can be seen graphically in Figure 9 and the test by item similarity interaction significance can be seen in Figures 5, 6, 7, and 8. It appears that the similarity effect was a facilitive factor aiding the subjects in identifying the correct response, when the preexperimental frequency differential could be used as a cue.

Since the subjects had no prior knowledge of the test composition, it was assumed that the results of the first trial should show complete randomization of choice over all subjects for all tests. This randomization was tested using a Chi-Square approximation with one df for each test and then by a pooled Chi-Square over all tests with four df's. The results of the Chi-Square tests (Table VII) show no statistical significance at the .05 level for any of the test modes. Therefore it was concluded that the results of the first trial for all of the subjects over the four test modes were completely random and that the original assumption in applying information theory to this situation was justified.

TABLE VII

CHI-SQUARE ANALYSIS FOR RANDOMIZATION
COMBINING DATA OVER ALL TESTS

TEST	SAMPLE SIZE	NUMBER CORRECT	NUMBER INCORRECT	X^2	df
I	120	46	74	1.134	1
II	120	31	89	2.709	1
III	120	44	76	0.459	1
IV	120	39	81	0.009	1
Pooled X^2	----------	----------	----------	4.311	4
TOTAL	480	160	320	0.000	1

IV. DISCUSSION

The results of the experiment tended to contradict several hypotheses of previous works in VD learning. In the absence of statistical significance between the test modes the experiment led to a contradiction of the frequency theory of Ekstrand et al., (1966) as presented for pair-wise VD lists. This contradiction occured in spite of the expected transfer of informational value, that is, subjects participating in Tests I and III should have been able to demonstrate more rapid learning of correct responses. One explanation for the contradiction to the frequency theory lies in the underlying assumptions on which the experiment was based, that the subjects can differentiate the frequency ratios of the VD lists. The frequency ratios used, 3:1:1 and 1:2:2 may not have provided adequate separation between words to substantiate this assumption. If this assumption was erroneous then the frequency keying did not occur, subjects failed to select the proper rule and continued to select alternate responses for non-reinforced words by chance. Progress therefore continued from trial to trial strictly as a factor of rote learning.

Another contradiction from previous experiments was in the apparently facilitive factor of item similarity. Ekstrand, et al. (1966) indicated that item similarity should produce interference; however, as can be seen in Figures 5 and 7, item similarity was a significant factor in Test modes I and III where preexperimental frequency differentials could be used as a cue. In Figures 6 and 8, representing test modes II and IV, where the preexperimental frequency differential could not be used as a cue, similarity did not show a facilitation of learning. Accordingly,

it can be concluded that differential response frequency is more readily established among words in the same category. Thus, when words came from the same category, subjects were able to use background or preexperimental frequency as a cue, and the predictions originally made are confirmed.

Since the items were chosen from words with a high background frequency, discriminations may have also been even more difficult according to the Weber's Law analogy used by Kausler and Farzanegan (1969).

In view of these results, background exposure in relatively low frequency ratios of 2:1 or 3:1 did not, in general, appear to provide a sufficient cue to subjects for discriminating correct and incorrect responses in a three-word VD list. Experiments conducted with greater frequency separation than used in this experiment, however, may produce entirely different results similar to those found in this study for the similar VD items.

APPENDIX A

SUBJECT'S INSTRUCTIONS

You are about to participate in a verbal discrimination experiment. During the experiment you will be shown twelve groups of words, each group consisting of three words, one of which has arbitrarily been selected as a "correct" response for that group. You will observe each group for a period of two seconds followed by a two second response interval. During the response interval you are to reply with one of the three words just observed. If your choice is correct, you will receive "correct" from the test administrator. If your choice is in error the test administrator will say nothing. The twelve groups of words will be repeated for eight trials. During each trial the words within each group and the groups within each list will be rearranged, however, the correct response for each group of three words will remain the same on all trials. Your objective is to identify as many correct responses as possible on each trial.

Do you have any questions?

I wish to thank you for your assistance and would appreciate it if you would not discuss this experiment with other students who might serve in the study.

APPENDIX B

NUMBER OF CORRECT RESPONSES PER SUBJECT OVER TRIALS

LIST HLL HIGH CORRECT

SIMILAR WORDS

SUBJECTS	TRIALS							
	1	2	3	4	5	6	7	8
1	1	3	3	4	5	3	4	5
2	4	5	5	5	6	6	6	6
3	1	2	4	4	5	5	5	6
4	2	3	4	5	4	5	5	6
5	2	1	3	2	2	2	2	2
6	2	2	4	3	3	6	6	6
7	3	3	4	5	4	5	5	6
8	2	4	4	1	1	2	3	3
9	2	4	3	5	5	6	5	5
10	3	4	6	6	6	6	6	6

DISSIMILAR WORDS

	1	2	3	4	5	6	7	8
1	2	1	1	2	0	2	3	4
2	2	3	1	3	2	4	6	6
3	4	1	3	2	4	6	6	6
4	1	2	4	4	5	5	5	5
5	2	3	5	3	3	3	5	6
6	1	2	4	2	4	4	5	5
7	2	2	3	3	3	4	4	3
8	2	2	3	2	2	1	0	3
9	4	3	4	5	5	5	5	5
10	4	4	4	5	6	6	6	6

LIST HLL LOW CORRECT

SIMILAR WORDS

SUBJECTS	TRIALS							
	1	2	3	4	5	6	7	8
11	2	0	3	3	2	1	2	3
12	2	3	5	4	5	6	6	6
13	2	3	3	5	2	4	4	4
14	2	2	4	3	5	6	6	6
15	2	2	4	3	3	3	5	5
16	2	2	3	3	4	4	5	6
17	0	4	2	4	3	6	5	5
18	0	3	2	5	4	5	6	4
19	2	3	4	3	5	5	6	6
20	2	2	1	2	3	3	6	5

DISSIMILAR WORDS

	1	2	3	4	5	6	7	8
11	1	3	4	3	2	1	5	2
12	2	2	2	3	6	5	6	6
13	2	3	3	5	5	5	6	5
14	2	1	1	3	3	5	6	6
15	0	3	4	5	6	6	5	5
16	2	2	4	5	5	5	5	5
17	2	1	2	3	4	3	5	6
18	1	1	2	2	3	2	2	3
19	2	2	5	4	4	5	5	4
20	2	1	2	4	3	5	6	6

LIST LHH LOW CORRECT

SIMILAR WORDS

SUBJECTS	TRIALS							
	1	2	3	4	5	6	7	8
21	1	2	5	5	4	5	4	4
22	2	4	1	3	5	5	5	6
23	2	4	3	3	5	4	5	5
24	4	3	4	5	5	5	6	6
25	1	3	4	4	3	3	6	6
26	2	3	3	4	5	6	6	6
27	2	3	6	5	4	5	6	6
28	2	4	4	4	5	6	6	6
29	3	3	2	3	3	4	5	6
30	3	3	5	5	5	6	5	5

DISSIMILAR WORDS

	1	2	3	4	5	6	7	8
21	2	0	2	2	3	6	6	6
22	1	1	2	3	4	4	5	6
23	4	1	3	4	6	6	6	6
24	1	4	3	3	4	6	6	6
25	3	2	1	1	1	2	3	4
26	3	3	2	6	6	4	5	5
27	3	3	4	3	5	6	6	5
28	0	3	6	4	4	5	5	6
29	2	1	2	0	2	1	3	3
30	3	4	5	4	4	5	4	5

LIST LHH HIGH CORRECT

SIMILAR WORDS

SUBJECTS	TRIALS							
	1	2	3	4	5	6	7	8
31	2	3	3	2	2	3	3	4
32	4	4	3	2	4	3	2	4
33	2	3	3	6	6	6	6	6
34	1	3	2	2	2	4	3	2
35	3	2	4	6	6	5	6	6
36	1	4	3	3	4	6	6	6
37	2	3	3	3	5	5	6	6
38	4	3	4	5	5	4	5	5
39	0	4	2	0	4	3	4	5
40	2	3	3	3	2	4	3	4

	DISSIMILAR WORDS							
	1	2	3	4	5	6	7	8
31	0	3	1	2	5	5	3	3
32	4	2	3	6	3	5	5	5
33	3	3	5	6	6	6	6	6
34	2	3	3	2	4	5	5	5
35	0	4	3	5	5	6	6	6
36	2	4	3	4	4	4	5	6
37	2	1	4	5	5	6	6	6
38	2	2	0	2	5	5	6	7
39	1	4	3	4	2	3	5	4
40	2	1	3	3	5	2	4	6

APPENDIX C

NUMBER OF CORRECT RESPONSES FOR CORRECT RESPONSE WORD (POSTERIOR DISTRIBUTION)

LIST HLL

HIGH CORRECT

RESPONSE WORD	TRIALS 1	2	3	4	5	6	7	8
HOUR	5	4	4	3	9	6	7	8
CHINA	4	5	8	7	7	7	9	8
PEA	3	4	7	6	6	8	8	10
VAN	5	4	7	5	5	8	7	8
TYPHOID	2	4	1	4	2	4	8	7
PRUNE	6	2	4	6	6	7	6	9
SOCK*	4	4	7	6	7	8	9	9
GOLD*	5	6	6	7	5	8	6	8
GREECE*	2	5	6	7	7	9	8	9
MODERN*	4	7	8	7	8	7	8	8
PLUM*	4	4	7	5	6	7	7	9
CANVAS*	3	5	6	8	7	7	9	8

* denotes similar word groups

LIST HLL

LOW CORRECT

RESPONSE WORD	TRIALS 1	2	3	4	5	6	7	8
SPOON	0	3	8	7	7	7	10	8
HIP	5	1	4	6	7	7	8	7
NIECE	3	6	5	9	8	9	10	10
LIVER	6	4	4	7	6	7	6	7
LADLE	2	4	3	6	7	8	8	8
THRUSH	0	1	3	5	5	6	9	8
CLOG*	2	4	3	4	5	6	7	6
TIN*	1	5	3	8	7	8	9	8
CUBA*	5	6	6	7	8	7	10	9
SWING*	1	4	7	5	6	7	9	8
APRICOT*	4	1	4	7	6	8	9	9
TWEED*	3	3	6	6	4	5	7	9

* Denotes similar word groups

LIST LHH

LOW CORRECT

RESPONSE WORD	TRIALS 1	2	3	4	5	6	7	8
TEA	4	3	8	3	7	7	8	8
OXYGEN	5	5	5	4	5	9	9	7
ONION	4	3	6	5	6	7	8	9
TRACK	4	4	2	5	7	6	7	9
CARL	3	4	6	7	8	7	8	9
MEDICINE	5	3	3	5	7	9	9	10
FRAME*	6	5	7	9	10	8	9	9
NOUN*	1	4	4	7	6	8	9	9
THUNDER*	5	7	9	9	8	10	10	10
WREN*	3	6	6	6	7	8	8	10
BAT*	4	5	5	6	7	7	9	9
JANE*	0	5	6	5	5	8	9	9

* Denotes similar word groups

LIST LHH

HIGH CORRECT

RESPONSE WORD	TRIALS 1	2	3	4	5	6	7	8
UNCLE	2	6	3	6	5	7	9	10
PINK	3	5	3	7	7	7	8	8
SENATE	5	5	7	7	10	10	9	9
BLUE	3	6	5	5	7	5	8	9
APPLE	2	3	5	6	9	7	8	8
MOTHER	3	2	5	8	7	10	9	9
DOOR*	5	6	6	2	4	6	7	6
VERB*	3	6	6	7	7	7	8	8
WIND*	1	3	3	4	6	5	5	7
DOVE*	6	7	6	9	9	9	8	9
PUZZLE*	3	5	4	4	8	7	8	9
MARY*	3	5	5	6	6	10	8	9

* Denotes similar word groups

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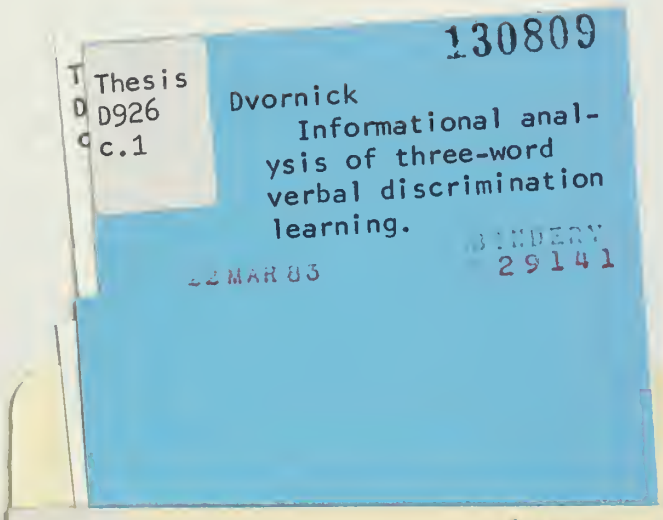
13. ABSTRACT

Forty Naval Postgraduate School students participated in a verbal discrimination (VD) experiment using three-word items of different frequency ratios. Half of the three-word items were composed of similar words and half, dissimilar words. Based on information theory the words were grouped into two lists, both of equal length and approximately equal information. Performance by the subjects showed statistical significance for the trial and item similarity interaction. The effect of using different frequency ratios within the separate word lists showed a facilitation of learning only for items with similar words. Apparently, the differential ratios were not sufficiently apparent in the dissimilar items to permit the use of preexperimental frequency differences as a cue to learning.

KEY WORDS	LINK A		LINK B		LINK C	
	ROLE	WT	ROLE	WT	ROLE	WT
VERBAL DISCRIMINATION LEARNING						
INFORMATION THEORY						
HUMAN LEARNING						
ROTE LEARNING						



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